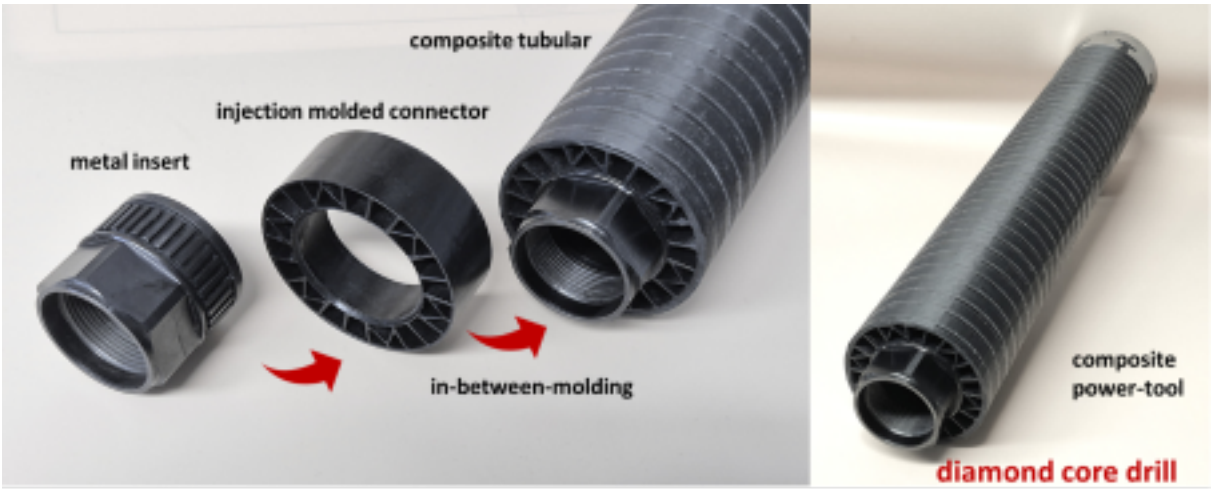
Integrated process chain: efficient production of hybrid thermoplastic hollow profiles

About this project



WI-IN

Integrated process chain: efficient production of hybrid thermoplastic hollow profiles

Markets:

Material: Carbon fibres, Thermoplastics, Carbon-fiber reinforced plastics (CFRP)

This project is funded by the Technology Transfer Programme Leichtbau (TTP LB) of the Federal Ministry of Economics and Energy.

Technology Transfer Program Leichtbau

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Context

Hybrid thermoplastic hollow structures offer great potential for lightweight construction, for example in hand-held power tools, rotating shafts or functional support structures. They combine high rigidity with low weight and enable the integration of additional functions.

In practice, companies have usually manufactured such components in separate process steps: continuous fibre-reinforced tubes are manufactured, transported and then functionalised, often with additional assembly or bonding processes. This increases the use of materials, energy requirements and logistical effort. At the same time, different materials and process chains make it difficult to use recycled materials and close material cycles.

Against this backdrop, production chains are needed that enable structural design and functional integration without additional intermediate logistics, reduce material losses and ensure the use of recyclates even in demanding applications. In addition, process data must be available in such a way that quality and energy consumption can be evaluated across the entire process chain. This is where the WI-IN project comes in.

Purpose

The project team is developing a production cell that combines the manufacture and functionalisation of hollow thermoplastic profiles in a continuous process. The participants are designing the process in such a way that as little material as possible is lost and a high proportion of recycled plastics can be used reliably. To this end, they develop material combinations based on polypropylene, ensure that the winding structure and injection moulding elements are permanently bonded together and test the recyclability of the components.

Using a demonstrator from the power tooling sector - i.e. hand-held, motorised power tools - the consortium is showing how load-bearing and functional elements can be combined in one component. In addition, the team is analysing the ecological effects with a systematic life cycle assessment and evaluating how the material can be returned to a closed material cycle after the use phase.

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Procedure

First, the participants design a flexible production cell that combines laser-based tape winding and mobile injection moulding in terms of space and control. Building on this, they develop tools, interfaces and control concepts so that both processes work together in a harmonised sequence. At the same time, the project team is characterising the materials used, including recyclates, and investigating the composite behaviour and process stability.

The project partners then develop demonstrator components, test them mechanically and evaluate them in terms of function, quality and reproducibility. A digital process data management system records relevant parameters along the entire chain and supports monitoring and quality assurance. Finally, results from production, testing and life cycle assessment are incorporated into the evaluation of industrial transferability and resource efficiency.

Funding duration:

Funding sign:	03LB2056	**Funding amount:**	EUR 1.7 million

Final report

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB2056A - WI-IN in the federal funding catalogue

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Project coordination

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English (EN){{ Projektpartner }}

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Lightweighting classification

	Realisation
Offer	
Products Parts and components, Semi-finished parts, Machines and plants	✓
Services & consulting Simulation	✓
Field of technology	
Design & layout Lightweight manufacturing, Hybrid structures	✓
Functional integration	
Measuring and testing technology Component and part analysis	✓
Modelling and simulation Structural mechanics, Materials	✓
Plant construction & automation Plant construction, Automation technology, Robotics	✓
Recycling technologies Recycling	✓

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Lightweighting classification

	Realisation
Manufacturing process	
Additive manufacturing Others (Mobile injection moulding and laser-based thermoplastic tape winding)	✓
Coating (surface engineering)	
Fibre composite technology Pre-preg processing, Others (Laser-based thermoplastic tape winding)	✓
Forming	
Joining Welding, Others (Mobile injection moulding)	✓
Material property alteration	
Primary forming Injection moulding	✓
Processing and separating	
Textile technology Others (Production Thermoplastic tape, injection moulding with reinforcing fibre content)	✓

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Lightweighting classification

	Realisation
Material	
Biogenic materials	
Cellular materials (foam materials)	
Composites Carbon-fiber reinforced plastics (CFRP)	✓
Fibres Carbon fibres	✓
Functional materials	
Metals	
Plastics Thermoplastics	✓
Structural ceramics	
(Technical) textiles	